CHICOT LAKE TMDL FOR NUTRIENTS AND NOXIOUS AQUATIC PLANTS

SUBSEGMENT 060203

US EPA Region 6

Final

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to establish total maximum daily loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. This TMDL addresses two causes of impairment of Chicot Lake that are linked: nutrients and noxious aquatic plants.

Chicot Lake, subsegment 060203, is an impoundment that was created by building a dam across Bayou Chicot. Subsegment 060203 was listed for nutrients and noxious aquatic plants on the October 28, 1999 Court Ordered §303(d) list as not fully supporting the water quality standards for propagation of fish and wildlife, and was ranked as high priority for TMDL development. In the State of Louisiana Surface Water Quality Standards, the general criterion for nutrients states "The naturally occurring range of nitrogen-phosphorus ratios shall be maintained…. Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters." In addition, LDEQ issued a declaratory ruling on April 29, 1996, concerning this language and stated, "That DO directly correlates with overall nutrient impact is a well-established biological and ecological principle. Thus, when the LDEQ maintains and protects DO, the LDEQ is in effect also limiting and controlling nutrient concentrations and impacts." As a result, this TMDL sets out the reduction in nutrient loading required to attain dissolved oxygen standards. The current applicable DO criterion for Chicot Lake is 5.0 mg/L year-round.

EPA has identified nutrient ratios using eight years of historical values in the State of Louisiana's database, and ranges of ratios found in scientific literature indicating nitrogen or phosphorus limitation. Literature generally indicates that where the nitrogen to phosphorus ratio is less than ten, a water body system is considered to be nitrogen limited. Review of historical State data for Bayou Chicot indicates that 25 out of 50 assessed sampling events displayed nitrogen limitation ratios (Appendix A). Since 50% of the sampling events confirmed nitrogen limiting conditions and 50% confirmed phosphorus-limiting conditions, a more detailed review of the data was conducted. In reviewing the variability in total phosphorus and total nitrogen concentrations for the seven years of data, it is apparent that nitrogen is the limiting factor. Total phosphorus varies little over the specified time period ranging from 0.01 to 1.03 mg/L compared to total nitrogen, which ranges from 0.17 to 3.74 mg/L. Reducing the nitrogen inputs will in turn reduce the nitrogen to phosphorus ratio; therefore it has been concluded that a nitrogen TMDL for Chicot Lake is appropriate. A TMDL for phosphorus is not necessary because controls on nitrogen will maintain naturally occurring nitrogen-phosphorus ratios. Therefore, the nitrogen loading required to maintain the dissolved oxygen standard will constitute the nutrient TMDL.

A load allocation of zero and a wasteload allocation of zero for noxious aquatic plants (native and invasive species) have been established in this TMDL. Invasive species have an extremely high rate of plant growth, therefore, exotic plant growth needs to be controlled to zero levels to avoid re-introduction and regrowth. Natural and anthropogenic nutrient enrichment contributes to noxious aquatic plant growth in Chicot Lake. A reduction of nitrogen input into Chicot Lake

will reduce noxious aquatic plant growth in the lake. Therefore, in this TMDL, the nitrogen loading required to control excessive plant growth will serve as part of the noxious aquatic plant TMDL. Additional in-lake macrophyte control methods may also be needed beyond nutrient reductions to control plant growth to the level needed to meet the designated use of fish and wildlife propagation.

Consistent with EPA's obligations in Sierra Club, et al. v. Gerald Clifford, et al., 96-0527 (E.D. La.) to establish TMDLs for waters on Louisiana's 303(d) list, and the suspected correlation between reduction of nitrogen input into Chicot Lake and reduction of noxious aquatic plant growth, EPA is establishing this nutrient and noxious aquatic plant TMDL. EPA interprets Section 303(d) to require that TMDLs must be established where a waterbody is impaired or threatened by a "pollutant". EPA considers the noxious aquatic plant growth in Chicot Lake to be a "pollutant" within the meaning of Section 502(6) of the Clean Water Act. Today's action does not represent a determination by the Agency that Section 303(d) listings for such impairments as "noxious aquatic plants", "invasive species" or "exotic species" are in all cases "pollutants" within the meaning of Section 502(6) of the Clean Water Act. In 1978, EPA decided that all pollutants, under proper technical conditions are suitable for the calculation of TMDLs (43 Fed. Reg. 60662, December 28, 1978). EPA may reevaluate whether materials such as "noxious aquatic plants" are pollutants, generally or in individual situations, for Clean Water Act purposes.

There is one direct point source discharger to Chicot Lake and one point source discharger located on a tributary flowing into Chicot Lake. This nutrient and noxious aquatic plant TMDL includes two point source dischargers, waste load allocations (WLAs), load allocations (LAs), and margins of safety (MOS). As presented in FTN Associates, Ltd. (2000), the summer season DO criterion of 5.0 mg/L can be maintained with a 100% reduction of all manmade nonpoint sources. For the winter season, the DO criterion of 5.0 mg/L can be maintained with a 93% reduction from all manmade nonpoint sources. We believe that during the summer season, a 100% reduction of all manmade nonpoint sources for nutrients will reduce noxious aquatic plant growth during the summer season. Likewise, a reduction of 93% of during the winter season will reduce noxious aquatic plant growth during the winter growing season. Additional in-lake macrophyte control methods may be needed beyond nutrient management methods to reduce plant growth and meet water quality standards.

1. Introduction

Chicot lake, subsegment 060203, was listed on the October 28, 1999 Court Ordered §303(d) list as not fully supporting the water quality standard for the propagation of fish and wildlife. A TMDL for nutrients and noxious aquatic plants was developed in accordance with the requirements of Section 303(d) of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. This TMDL includes a wasteload allocation (WLA), a load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the portion of the load capacity allocated to point sources for the pollutant of concern, and the load allocation is the portion of the load capacity allocated to nonpoint sources and/or to natural background. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions and data inadequacies.

2. Study Area Description

2.1 Chicot Lake, Subsegment 060203

Chicot Lake is an impoundment that was created by building a dam across Bayou Chicot. The dam has an uncontrolled overflow spillway (i.e., functions as a weir). The lake is approximately 16-17 feet deep near the dam and drains approximately 36 square miles (USGS 1971). There are many trees in shallower parts of the lake, particularly near the upstream (south) end. Nearby land use within the watershed (Segment 0602) is predominantly agriculture and forestry. The major land uses are listed in Table 1. See FTN Associates, Ltd. (2000) for additional detail, description and discussion of the study area.

Table 1. Land Uses in WQ Segments 0602.
Source: LDEQ, 1993.

	% of Total Area
Land Use Type	Segment 0602
Urban	4.5
Extractive	0.3
Agricultural	64.1
Forest Land	23.2
Water	0.5
Wetland	6.9
Barren land	0.4
Other	0.0
TOTAL	100

2.2 Water Quality Standards

The designated uses for Chicot Lake include primary and secondary contact recreation and the propagation of fish and wildlife. In the State of Louisiana Surface Water Quality Standards, the general criterion for nutrients states "The naturally occurring range of nitrogen-phosphorus ratios shall be maintained. Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters." In addition, LDEQ issued a declaratory ruling on April 29, 1996, concerning this language and stated, "That DO directly correlates with overall nutrient impact is a well-established biological and ecological principle. Thus, when the LDEQ maintains and protects DO, the LDEQ is in effect also limiting and controlling nutrient concentrations and impacts." DO serves as the indicator of whether a water body is meeting the narrative water quality criteria for nitrogen and for assessment of use support. In this TMDL, the nutrient loading required to maintain the dissolved oxygen standard is the nutrient TMDL.

EPA has identified nutrient ratios using historical values in the State of Louisiana's database, and ranges of ratios found in scientific literature indicating nitrogen or phosphorus limitation. Based upon the literature, nitrogen to phosphorus ratios of less than ten are generally indicative of a nitrogen limited water body system (Wetzel 1975, Day 1989, Allan 1995). The eight-year average for nitrogen to phosphorus ratio (February 1991 through December 1998) in Chicot Lake is 10.62 after the removal of three statistical outliers (Appendix A). Since 50% of the sampling events confirmed nitrogen limiting conditions and 50% confirmed phosphorus-limiting conditions, an in-depth review of the data was conducted. A review of the variability in total phosphorus and total nitrogen concentrations for the seven years of data reveals that nitrogen is the limiting factor. Total phosphorus varies little over the specified time period ranging from 0.01 to 1.03 mg/L compared to total nitrogen, which ranges from 0.17 to 3.74 mg/L. Reducing the nitrogen inputs will in turn reduce the nitrogen to phosphorus ratio; therefore, a nitrogen TMDL for Chicot Lake will obviate the need for a separate phosphorous TMDL. A TMDL for phosphorus is not necessary because controls on nitrogen will maintain naturally occurring nitrogen-phosphorus ratios. Therefore, the nitrogen loading required to maintain the dissolved oxygen standard will constitute the nutrient TMDL. The current applicable dissolved oxygen DO criterion is 5.0 mg/L year-round.

In addition, LDEQ Water Quality general standards at §1113.B.1.e provides that all waters be free from such concentrations of substances attributable to wastewater or other discharges sufficient to produce undesirable or nuisance aquatic life. These general and numeric standards are established to promote restoration, maintenance, and protection of state waters. Due to typical storage of nutrients in lake sediment, and the very fast rate of growth of native and invasive noxious aquatic plants, reducing nutrient loadings by themselves is not expected to reduce nuisance aquatic plant growth to a level necessary to meet this standard and restore the designated use of fish and wildlife propagation (see discussion in Section 2.3). Therefore, in addition to the nutrient loadings being established, a noxious aquatic plant loading is established to meet this narrative water quality criterion.

2.3 Identification of Sources

2.3.1 Nitrogen

The sources identified in the *1998 Louisiana Water Quality Inventory* as affecting the water quality of Chicot Lake are designated as "Other" (natural sources) (LDEQ, 1998). Suspected sources identified in the State's 1993 Nonpoint Source §319 Report include point sources, non-irrigated crop production, aquaculture, petroleum activities, land disposal, and natural sources (LDEQ 1993).

2.3.2 Noxious aquatic plants

Direct verbal and written communication with the Louisiana Department of Wildlife and Fisheries (LDWF) indicates that both exotic and native aquatic macrophytes require control in this water body in order to meet the designated use of fish and wildlife propagation (Personal Communication LDWF, November 2000). Table 2 summarizes both native and invasive noxious aquatic plants that LDWF have identified as contributing to impairment of the fish and wildlife propagation water quality standard in Chicot Lake. These include submersed, floating and immersed species of plants. Hydrilla (*Hydrilla verticillata*) has been identified as one of the most problematic noxious aquatic species in Chicot Lake. Noxious aquatic plant growth in Chicot Lake is probably the result of natural and anthropogenic nutrient enrichment. Limited historical water quality data show a slightly increasing trend in total nitrogen concentrations (see Appendix A). This TMDL is premised on the linkage between nitrogen levels and noxious aquatic plant growth in Chicot Lake, which is that reductions in nitrogen loadings to the lake will lead to reduced plant growth and infestation, and thereby contribute to reaching the goal of attaining the dissolved oxygen standard.

Table 2. Exotic invasive and dominant native aquatic plant species

Exotic invasive species	Dominant native species
hydrilla (*Hydrilla verticillata*)	coontail (*Ceratophyllum demersum*)
milfoil (*Myriophyllum heterophyllum)*	fanwort (*Cabomba caroliniana*)
water hyacinth (*Eichhornia crassipes)*	southern water grass (*Hydrochloa caroliniensis*)
salvinia (*Salvinia minima*)	duckweed (*Lemna minor*)
alligator weed (*Alteranthera philoxeroides)*	watershield (*Brasenia schreberi*)
	American lotus (*Nelumbo lutea*)

Source: LDWF, Personal Communication, 2000.

There is a complex relationship between nutrient loading and macrophyte growth in lakes. In algal or non-rooted macrophyte dominated systems, nutrient reduction in the water column can be expected to show a positive effect, usually resulting in a direct reduction of noxious aquatic plant growth to meet water quality standards. However, for waters where rooted macrophytes dominate, or where fast-growing invasive aquatic species exist, as is the case in Chicot Lake, the situation is more complex. In the first case, the rooted macrophytes may derive much of their needed nutrients from nutrient laden sediments. In such cases the response of the rooted

macrophytes to water column reductions of nutrients will be slower than that of non-rooted macrophytes that rely on the water column for their nutrients. Consequently, controlling nutrient loadings may not be adequate to reduce noxious aquatic plant growth. Therefore, additional in-lake management measures may be required to achieve reductions in plant biomass to meet water quality standards.

In the second case, where invasive plant species are present, their extremely high rate of growth and reproduction in the waterbody can lead to significant proliferation and water quality impairment, even in the absence or control of nutrient enrichment. In addition, invasive species may also be brought in from other waterbodies, usually by watercraft, and establish new populations of nuisance aquatic species, thereby contributing to non-attainment of the designated uses. LDWF has indicated that noxious aquatic invasive species growth and proliferation, and additional introduction of noxious aquatics probably by boat traffic, is impairing Chicot Lake. It is likely that additional control methods may be needed to reduce noxious aquatic plant growth necessary to meet the water quality standards. These may include plant harvesting, application of herbicides, active drawdown, and other near-lake controls to prevent re-establishment of noxious plant populations from outside sources.

2.3.3 Point Sources

There is one direct point source discharger to Chicot Lake and one point source discharger located on a tributary flowing into Chicot Lake (see Table 3). EPA expects nutrient contributions from the point source dischargers to be controlled through NPDES permit limits for NH_3-N, which is representative of total nitrogen.

2.3.4 Nonpoint Sources

There is insufficient information available to assign nonpoint loads to specific sources in this system. Based on land use in the watershed there is potential for nitrogen input through nonpoint source loading (see Table 1).

3. TMDL Load/Wasteload Calculations

FTN Associates, Ltd. submitted a DO model for Chicot Lake, subsegment 060203, in December 1999 and a revised model in September 2000 (FTN Associates, Ltd. 2000). EPA reviewed the model and determined that it was appropriate for use in establishing this TMDL. This model was used to calculate the needed nutrient reductions for this subsegment. Tables 2.3 and 4.3 in the DO TMDL modeling report (FTN Associates, Ltd. 2000) included cumulative WLAs, LAs, and MOS for five point source dischargers. The individual discharger WLAs were recalculated based on $CBOD_5$ and NH_3-N concentrations as listed in FTN's summer and winter TMDL calculations for Chicot Lake (FTN Associates Ltd., 2000). Tables 3 and 4 present the WLAs, LAs, and MOS for this nutrient TMDL.

Table 3. Point Source Wasteload Allocations

Dischargers to Bayou Cocodrie Watershed Subsegment 060203											
Facility	Permit #	Receiving Water	Discharge Flow MGD	Summer CBOD5/ NH3-N/ Org-N mg/l	Winter CBOD5/ NH3-N/ Org-N mg/l	Summer CBOD5 WLA lbs/day	Summer NH3-N WLA lbs/day	Summer Org-N WLA lbs/day	Winter CBOD5 WLA lbs/day	Winter NH3-N WLA lbs/day	Winter Org-N WLA lbs/day
Chicot State Park *WWTP	LAG540413	Lake Chicot	0.012	10/10/5	30/15/7.5	1.0	1.00	0.50	3.00	1.50	0.75
Plaquemines Alligator Farm **	LA0109011	Choctaw Bayou, then to Lake Chicot	0.080	10/5/2.5	10/25/12.5	6.67	3.34	1.67	6.67	16.68	8.34
		TOTAL				7.67	4.34	2.17	9.67	18.18	9.09
		TOTAL (NH3-N * 4.3=UNBOD)					18.66			78.17	
		TOTAL (Org-N * 4.3=UNBOD)						9.33			39.10
		TOTAL (CBOD5 * 2.3=UCBOD)				17.64			22.24		

The individual discharger WLAs were recalculated based on $CBOD_5$ and NH_3-N concentrations as listed in FTN's summer and winter TMDL calculations for Bayou Cocodrie. Tables 3 and 4 present the WLAs, LAs, and MOS for this ammonia TMDL. Note that there is a difference of 1.23 lbs/day of UBOD for summer and 3.31 lbs/day of UBOD for winter, when comparing the UBOD values presented in Tables 3 and 4. This is due to the rounding errors that occurred when calculating the individual WLAs.

* Discharges directly into Chicot Lake.
** Discharages into tributary flowing into Chicot Lake.

3.1 Loading Capacity and TMDL Formulation

3.1.1 Nitrogen

According to FTN Associates, Ltd. (2000), input data for the calibration model were developed from the LDEQ Reference Stream Study, data collected during the 1999 intensive survey, data collected by LDEQ and USGS at several ambient monitoring stations in the watershed, DMRs, permits and permit applications for each of the point source dischargers, USGS drainage area and low flow publications, previous modeling studies conducted by LDEQ in the area, and data garnered from several previous LDEQ studies on non-point source loadings. A satisfactory calibration was achieved for the main stem and most of the tributaries modeled. In those cases where the calibration was not as accurate (primarily due to extremely limited data), the difference was in the conservative direction. For the projection models, data were taken from the current municipal discharge permits, current applications, and ambient temperature records.

Modeling was limited to low flow scenarios for both the calibration and the projections since the constituent of concern was dissolved oxygen and the available data was limited to low flow conditions. The model used was QUAL-TX, a modified version of the QUAL-II water quality modeling system. QUAL-TX was selected since it offers the ability to model branched systems and has been used successfully in Louisiana in the past. See FTN Associates, Ltd. (2000) for additional discussion of the modeling system used.

3.1.2 Noxious Aquatic Plants

The loading capacity for noxious aquatic plants is zero. Invasive species have an extremely high rate of plant growth, therefore, exotic noxious aquatic plant biomass should be controlled to zero levels to avoid re-introduction and re-growth.

3.2 Load Allocations

3.2.1 Nitrogen

Seasonal load allocations are presented in Table 4. See FTN Associates, Ltd. (2000) for a detailed discussion of load allocation. The load allocation in Table 4 is calculated using the sum of natural nonpoint source LAs and manmade nonpoint source LAs (See Appendix B, “Notes for TMDL calculations for Bayou Cocodrie Subsegment 060203”, provided to EPA by FTN Associates, Ltd., April 28, 2000)

As presented in FTN Associates, Ltd. (2000), the summer season DO criterion of 5.0 mg/L can be maintained with a 100% reduction of nitrogen from of all manmade nonpoint sources. For the winter season, the DO criterion of 5.0 mg/L can be maintained with a 93% reduction from all manmade nonpoint sources.

Table 4 Total Maximum Daily Loads

ALLOCATION	SUMMER (June – August) lbs/day UBOD=UCBOD+UNBOD+SOD	WINTER (September – May) lbs/day UBOD=UCBOD+UNBOD+SOD
Point Source WLA	44.4	136.2
Margin of Safety	14.2	750.9
Load Allocation	5653.5	30213.8
TMDL	5712.1	31100.9

3.2.2 Noxious aquatic plants

A load allocation for exotic, noxious aquatic plants of zero pounds of plant biomass is established in this TMDL. Because of the extremely high rate of invasive species plant growth, exotic noxious aquatic plants need to be controlled to zero levels to avoid reintroduction and re-growth.

3.3 Wasteload Allocations

3.3.1 Nitrogen

Seasonal wasteload allocations for individual point source dischargers are presented in Table 3. The total cumulative WLAs for summer and winter are presented in Table 4.

3.3.2 Noxious Aquatic Plants

The wasteload allocation for noxious aquatic plants is zero. No known point sources of noxious aquatic plants exist.

3.4 Seasonal Variation

Critical conditions for dissolved oxygen in Louisiana have been determined to be when there is negligible nonpoint run-off and low stream flow combined with high stream temperature. In addition, the models account for loadings that occur at higher flows by modeling sediment oxygen demand. Oxygen demanding pollutants that enter the stream during higher flows settle to the bottom and then exert the greatest oxygen demand during the high temperature seasons. Additionally, this TMDL looked at the winter and summer seasons by varying temperature.

3.5 Margin of Safety

The margin of safety (MOS) presented in Table 4 was calculated as the sum of point source reserve MOS and manmade nonpoint source reserve MOS (See Appendix B, “Notes for TMDL calculations for Bayou Cocodrie Subsegment 060203”, provided to EPA by FTN Associates, Ltd., April 28, 2000). The MOS accounts for any lack of knowledge or uncertainty concerning the relationship between load allocations and water quality. According to FTN Associates, Ltd.

(2000), the highest temperatures occur in July-August, the lowest stream flows occur in October-November, and the maximum point source discharge occurs following a significant rainfall, i.e. high-flow conditions. The combination of these conditions, in addition to other conservative assumptions regarding rates and loadings, yields an implied MOS that has not been quantified. Over and above this implicit MOS, LDEQ regularly uses an explicit MOS of 20% for point and up to 10% for nonpoint loads, as was done in this TMDL (See Appendix B).

4. Reasonable Assurance and Other Relevant Information

An implementation plan is not an approvable element of the TMDL, but nevertheless, EPA guidance provides that there should be reasonable assurance that the reductions established in the TMDL can be reached so as to meet water quality standards.

Although not required by this TMDL, LDEQ utilizes funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act to operate an established program for permitting, enforcement and monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins are monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following establishment of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Vermilion-Teche River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 - Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

The LDEQ also receives federal funding under the Clean Water Act Section 319(h) Nonpoint Source program. The Louisiana Nonpoint Source Management Plan identifies that the LDEQ will continue to work cooperatively with the federal, state and local partners that assist them in the implementation of statewide educational programs and watershed protection and restoration projects to restore the designated uses of waterbodies. The Management Plan also identifies the State's goal to address nonpoint sources of pollution in the Mermentau/Vermilion basin by the end of 2007. It is anticipated that the state will evaluate if actions have been successful in restoring designated uses in the Mermentau/Vermilion basins by the end of 2008.

In addition, as described above in Section 2, reduction of nutrient loadings may not be entirely adequate to control plant growth necessary to meet the water quality standards. These additional management methods may include plant harvesting, application of herbicides, active drawdown, and other near-lake controls to prevent re-establishment of noxious plant populations from outside sources. The LDWF has established a statewide program to manage problem aquatic vegetation. The Louisiana management philosophy is based on the belief that eradication of these problem species on a large scale is not feasible. The management philosophy and goal of the aquatic plant program for Louisiana is maintenance control. This is defined as "the strategy of keeping nuisance aquatic plants at their lowest feasible levels by a constant program of search and destroy of infestations." A number of alternatives have been explored in an effort to develop the most efficient, safe, and economical program for controlling nuisance aquatic plants in Louisiana. Consistent with the need to safeguard the environment, combinations of herbicide control (utilizing EPA approved herbicides), water level fluctuations and approved biological agents are the most efficient, economical and practical measures presently available for the aquatic plant management and control in Louisiana. The latest Chicot Lake management activity was a lake drawdown in the Summer of 1999. (LDWF, Personal Communication, 2000). Herbicide application has been used for the past three or four years to control hydrilla.

Finally, as part of the State of Louisiana's strategy to control the growth and spread of invasive aquatic plants, the LDWF has the following regulation concerning noxious aquatic plants in their recreational fishery regulations:

Noxious Aquatic Plants - Importation Prohibited

No person shall, at any time, knowingly import or cause to be transported into the jurisdiction of the state of Louisiana from any other state or country, without first obtaining a written permit from the Commission, any of the following noxious aquatic plants which are or can be grown submerged or partly submerged, or floating in water. Eichhornia azurea (rooting or anchoring hyacinth), Elodea Canadensis (elodea), Hydrilla spp. (hydrilla), Lagarosiphon muscoides &

Lagarosiphon major (African elodea), Myriophyllum spicatum (Eurasian watermilfoil), Najas marina (marine naiad), Najas minor (slender naiad), Panicum repens (torpedograss), Pontederia spp. (pickerelweed), Spirodela oligorrhiza (giant duckweed), Trapa (waterchestnut), Melaleuca quinquenvia (kapok tree), Pistia stratioties (water lettuce), Salvinia spp. (salvinia), Lythrum salicaria (purple loosestrife), Eichhornia crassipes (water hyacinth).

This ban on noxious aquatic species transport from other states or countries to Louisiana fresh waters should help to control the growth and proliferation of noxious aquatic plants in Chicot Lake that is required to meet the zero loading specified in the TMDL.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

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APPENDIX A. Nutrient data.

All nutrient data collected at Chicot Lake (February 1991 through December 1998) can be found on the Louisiana Department of Environmental Quality's web site at:

http://www.deq.state.la.us/surveillance/wqdata/0312wqnn.txt.

Date	NO_2+N O_3**	TKN	TP**	TOC	TN	N:P	N:P avg	Time	Depth
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			m
12/9/98	0.06	1.01	0.09	11.3	1.07	11.89	10.62	1000	1.0
11/23/98	0.08	0.09	0.07	11.2	0.17	2.43		1245	1.0
11/9/98	0.04	3.87	0.18	11.3	3.91	21.72		1000	0.7
10/27/98	0.08	0.81	0.08	10.7	0.89	11.13		1020	1.0
10/13/98	0.13	0.75	0.10	16.7	0.88	8.80		1000	1.0
9/22/98	0.02	0.69	0.07		0.71	10.14		1010	1.0
9/9/98	0.08	0.89	<0.05		0.97	19.40		942	1.0
8/25/98	0.07	1.26	0.05		1.33	26.60		1010	1.0
8/11/98	0.09	1.11	<0.05		1.20	24.00		1045	1.0
7/28/98	0.08	1.24	0.26		1.32	5.08		1040	1.0
7/14/98	0.17	0.72	0.12		0.89	7.42		930	1.0
6/23/98	0.10	1.03	0.11		1.13	10.27		1031	1.0
4/14/98								1032	1.0
2/10/98	0.16	0.93	0.07	6.9	1.09	15.57		1106	1.0
12/9/97	0.23	2.66	0.39	12.0	2.89	7.41		1003	1.0
10/14/97	0.47	2.91	0.23	14.4	3.38	14.70		952	1.0
8/12/97	0.03	0.79	0.08	11.5	0.82	10.25		1009	1.0
6/10/97	0.02	0.85	0.07	11.4	0.87	12.43		1024	1.0
4/15/97	0.08	1.01	0.19	10.8	1.09	5.74		925	1.0
2/18/97	0.20	1.20	0.15	13.7	1.40	9.33		1000	1.0
8/13/96	0.02	1.15	0.09	10.0	1.17	13.00		920	1.0
6/11/96	0.02	2.09	1.03	7.8	2.11	2.05		1010	1.0
4/9/96	<0.02	1.52	0.06	9.1	1.54	25.67		1015	1.0
2/13/96	0.40	0.71	0.15	9.0	1.11	7.40		1010	1.0
12/12/95	0.14	0.88	0.11	8.3	1.02	9.27		925	1.0
10/10/95	<0.02	1.12	0.10	8.6	1.14	11.40		1015	1.0
8/15/95	<0.01	0.65	<0.01	6.1	0.66	*66.00		1000	1.0
6/13/95	<0.02	0.94	0.14	7.6	0.96	6.86		943	1.0
4/5/95	<0.02	1.04	0.14	8.6	1.06	7.57		1010	1.0
2/14/95								1010	1.0
12/13/94	<0.02	0.69	0.04	8.6	0.71	17.75		955	1.0
10/11/94	<0.02	0.97	0.21	10.6	0.99	4.71		1010	1.0
8/9/94	0.08	0.67	0.06	9.4	0.75	12.50		1015	1.0
6/14/94	<0.02	1.17	0.18	10.5	1.19	6.61		1015	1.0
4/12/94	<0.02	0.59	<0.01	9.7	0.61	*61.00		917	1.0
2/8/94	0.05	0.88	<0.01	8.4	0.93	*93.00		1010	1.0
12/14/93	<0.03	0.22	0.04	8.5	0.25	6.25		1010	1.0
10/12/93	0.02	0.46	0.05	7.2	0.48	9.60		1025	1.0
8/10/93	0.07	0.75	0.07	8.2	0.82	11.71		925	1.0
6/15/93	<0.02	0.88	0.14	10.4	0.90	6.43		1000	1.0
4/13/93	0.02	0.80	0.11	11.8	0.82	7.45		1010	1.0

Date	NO_2+NO_3 mg/L	TKN mg/L	TP mg/L	TOC mg/L	TN mg/L	N:P mg/L	N:P avg	Time	Depth m
2/9/93	0.16	0.83	0.15	11.2	0.99	6.60		1015	1.0
12/15/92								1010	0.0
8/11/92	<0.02	0.98	0.10	9.1	1.00	10.00		920	1.0
6/16/92	<0.02	0.76	0.10	5.7	0.78	7.80		915	1.0
4/7/92	<0.02	0.56	0.07	7.8	0.58	8.29		815	1.0
2/11/92	0.15	0.68	0.12	6.6	0.83	6.92		945	1.0
12/9/91	<0.02	0.62	0.05	8.1	0.64	12.80		1010	1.0
10/15/91	<0.02	0.64	0.05	6.7	0.66	13.20		1110	1.0
8/13/91	<0.02	0.68	0.08	7.8	0.70	8.75		830	1.0
6/11/91	0.02	0.95	0.09	9.4	0.97	10.78		945	1.0
4/16/91	0.04	0.85	0.13	9.3	0.89	6.85		1120	1.0
2/5/91	0.14	0.95	0.17	10.0	1.09	6.41		930	1.0

* Statistical outliers – not used in calculation of the average N:P ratio.
** values signified with a "<" sign were used as listed in calculating N:P ratios.

APPENDIX B TMDL Calculations

Notes for TMDL calculations for Bayou Cocodrie Subsegment 060203
Source: FTN Associates Ltd. (provided to EPA 4/28/00)

INTERMED. CALCS (summer)	Oxygen demand (lb/day) from:				pg 1 of 1
	CBODu	NH3-N	Org N	SOD	
Manmade NPS loads:					
NPS loads not assoc. w/ flow	0.0	0.0	0.0	42.6	
Headwater and trib NPS loads	0.0	0.0	0.0	n.a.	
Total Manmade NPS loads	0.0	0.0	0.0	42.6	
Natural NPS loads:					
NPS loads not assoc. w/ flow	1801.7	106.4	142.7	3554.1	
Headwater and trib NPS loads	2.7	3.9	3.8	n.a.	
Total Natural NPS loads	1804.4	110.3	146.5	3554.1	

TMDL FOR SUMMER FOR BAYOU COCODRIE SYSTEM SUBSEGMENT 060203
(including Choctaw Bayou, Lake Chicot, and Bayou Chicot)

	Oxygen demand (lb/day) from:				Total oxygen demand
	CBODu	NH3-N	Org N	SOD	(lb/day)
WLA for point sources	17.1	18.2	9.1	n.a.	44.4
MOS for point sources	4.0	4.0	2.0	n.a.	9.9
LA for manmade nonpoint sources	0.0	0.0	0.0	38.3	38.3
MOS for manmade nonpoint sources	0.0	0.0	0.0	4.3	4.3
LA for natural nonpoint sources	1804.4	110.3	146.5	3554.1	5615.2
MOS for natural nonpoint sources	0.0	0.0	0.0	0.0	0.0
Total maximum daily load	1825.5	132.5	157.6	3596.6	5712.2

APPENDIX B continued

Notes for TMDL calculations for Bayou Cocodrie Subsegment 060203

INTERMED. CALCS (winter)	Oxygen demand (lb/day) from:				pg 1 of 1
	CBODu	NH3-N	Org N	SOD	
Manmade NPS loads:					
NPS loads not assoc. w/ flow	6085.4	5.9	0.0	1099.7	
Headwater and trib NPS loads	0.0	0.0	0.0	n.a.	
Total Manmade NPS loads	6085.4	5.9	0.0	1099.7	
Natural NPS loads:					
NPS loads not assoc. w/ flow	3722.4	1041.4	414.7	18459.5	
Headwater and trib NPS loads	27.0	39.0	38.1	n.a.	
Total Natural NPS loads	3749.4	1080.3	452.8	18459.5	

TMDL FOR WINTER FOR BAYOU COCODRIE SYSTEM SUBSEGMENT 060203
(including Choctaw Bayou, Lake Chicot, and Bayou Chicot)

	Oxygen demand (lb/day) from:				Total oxygen demand
	CBODu	NH3-N	Org N	SOD	(lb/day)
WLA for point sources	21.6	76.4	38.2	n.a.	136.2
MOS for point sources	4.5	18.2	9.1	n.a.	31.8
LA for manmade nonpoint sources	5476.8	5.3	0.0	989.7	6471.8
MOS for manmade nonpoint sources	608.5	0.6	0.0	110.0	719.1
LA for natural nonpoint sources	3749.4	1080.3	452.8	18459.5	23742.0
MOS for natural nonpoint sources	0.0	0.0	0.0	0.0	0.0
Total maximum daily load	9860.8	1180.8	500.1	19559.2	31100.8